Fishes and freshwater crayfishes of major catchments of the Leschenault Estuary: Preston and Brunswick River, including first record of a freshwater gudgeon (Eleotridae) from south-western Australia

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Abstract

A paucity of information exists on the fish and crayfish communities of two major rivers that flow into the Leschenault Inlet, south-western Western Australia. This study documents these communities and assesses their ecological significance. During February 2006, seven sites were sampled for fish and freshwater crayfish on each of the Brunswick River and Preston River with additional sites having been previously sampled in the summer of 1999/2000. The rivers generally had similar native fish communities with four endemic species, Freshwater Cobbler, Western Minnow, Western Pygmy Perch and Nightfish making up 60% of all fish captures (2670) with the remaining being from three feral freshwater and six estuarine species. Two native species of freshwater crayfish were also recorded, the Marron and Gilgie. The endemic Western Minnow and Western Pygmy Perch were the most common and widespread native fish species in both rivers. This study recorded what appears to be the Empire Gudgeon in the Preston River; the first record of this northern Australian species in the South-west Drainage Division, and its presence was attributed either to marine larval drift or as a result of an aquarium release. The potential impact of instream barriers on native fish migrations in these systems is discussed.

Keywords: freshwater fish, freshwater crayfish, Leschenault Estuary, Preston River, Brunswick River, south-west Australia.

Introduction

The Leschenault Inlet, located on southern Western Australia's Swan Coastal Plain near Bunbury receives discharge from the Brunswick, Collie, Preston and Ferguson Rivers. There is a considerable amount of information detailing the fish fauna of the Leschenault Inlet with Potter *et al.* (1997, 2000) recording 42 species of fish from 26 families. The estuary is dominated by gobies, atherinids and clupeids which comprised almost 90% of the fishes. Potter *et al.* (2000) also reported 13 species from gill net captures in the lower (tidal) Collie River. Neither of these studies reported on the fishes found within the freshwaters of the Leschenault Inlet catchment and although Pen & Potter (1990, 1991a, 1991b, 1991c, 1991d, 1992) conducted biological studies on a number of native and introduced freshwater fishes in the upper Collie River, there is no published information regarding the fishes (or freshwater crayfishes) of the Brunswick or Preston Rivers.

The distributions of fishes inhabiting the inland waters of the south-western corner of Western Australia were documented in Morgan *et al.* (1998) and include the systems from Capel to Two People's Bay east of Albany and thus does not encompass the more northerly Leschenault catchments, but does include some sites on the Collie River South Branch. The aims of the present study were to document the freshwater fishes and crayfishes of the Brunswick and Preston rivers and ameliorate the paucity of knowledge of the fishes and freshwater crayfishes inhabiting two of the major systems flowing into the Leschenault Inlet.

Methods

During February 2006, seven sites were sampled for fish and freshwater crayfish on each of the Brunswick River and Preston River (Fig. 1). An additional eight sites were sampled for freshwater fish in the Brunswick and Preston Rivers by the senior author in the summer of 1999/2000 (Fig. 1).

The sampling regime for fish and freshwater crayfish aimed at determining the densities of each species present at each site over an area of up to 340 m^2. A range of in-stream habitats at each site was sampled to account for differential use of micro-habitats by the prevailing species. At each site, stop nets were set upstream and downstream to block the escape of animals from the stream section. A combination of double-pass back-pack electrofishing (*Smith-Root Model 12-A*) and a variety of seine nets (in deeper habitats) were then deployed to record all animals in the stream section.

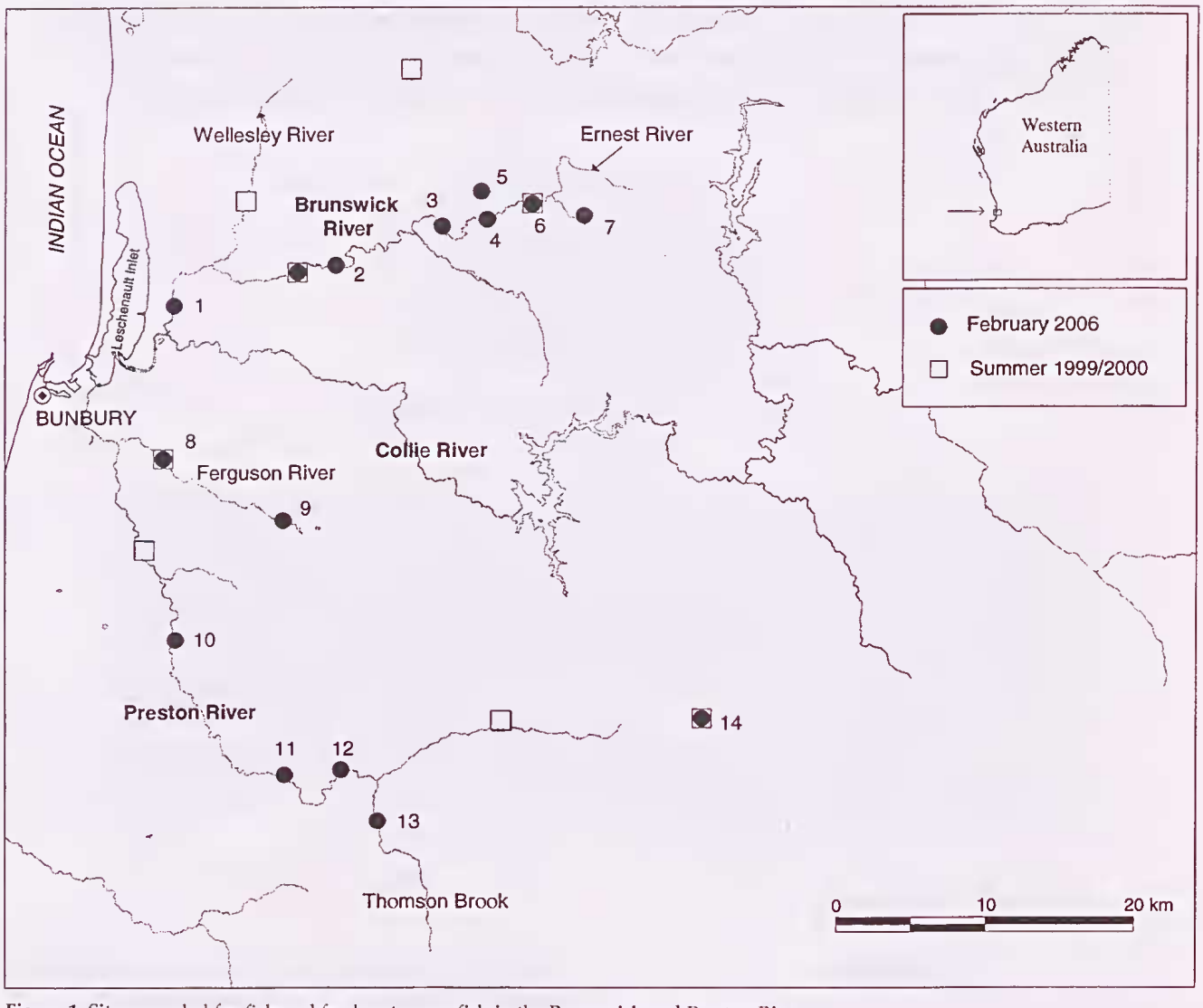

Figure 1. Sites sampled for fish and freshwater crayfish in the Brunswick and Preston Rivers.

Upon capture, all were identified, measured to the nearest 1 mm total length (TL) (for fish) or orbital carapace length (OCL) (for freshwater crayfish) and then promptly released. The density of each species at each blocked section was then determined.

Results

Fish species captured

A total of 1336 and 1334 fish were captured in the Brunswick and Preston Rivers, respectively. Within the Brunswick River however, 529 fish were from five estuarine species that were captured in a tidally influenced site. To allow comparisons between the fauna in the different systems we exclude this site and focus on those fishes captured at sites upstream of tidal influence.

Freshwater Endemic Fishes

During this study four of the eight species of freshwater fish endemic to south-western Australia were found within the catchments that drain into the Leschenault Inlet, including the Freshwater Cobbler (*Tandanus bostocki* Whitley, 1944), Western Minnow (*Galaxias occidentalis* Ogilby, 1899), Western Pygmy Perch (*Edelia vittata* Castelnau, 1873) and Nightfish (*Bostockia porosa* Castelneu, 1873) (Fig. 2).

Freshwater Cobbler was found in both the Brunswick (five fish from three sites) and Preston (four fish at one site) rivers and it is also known to be common throughout the Collie River, including Wellington Dam (Fig. 2). Within the Preston River it was only found at site 10 below the gauging station weir in Boyanup (Figures 1 and 2).

The Western Minnow was found to be widespread throughout both the Brunswick and Preston Rivers (Fig. 2). Within the Brunswick River our catches were dominated by larger (>1 year old) fish with only one fish <70 mm TL captured. In contrast, within the Preston River large numbers of new recruits (0+) were captured.

The Western Pygmy Perch was found to be widespread throughout both the Brunswick and Preston Rivers (Fig. 2). Similar to the Western Minnow, the population of Western Pygmy Perch within the Brunswick River was dominated by larger (>1 year old)

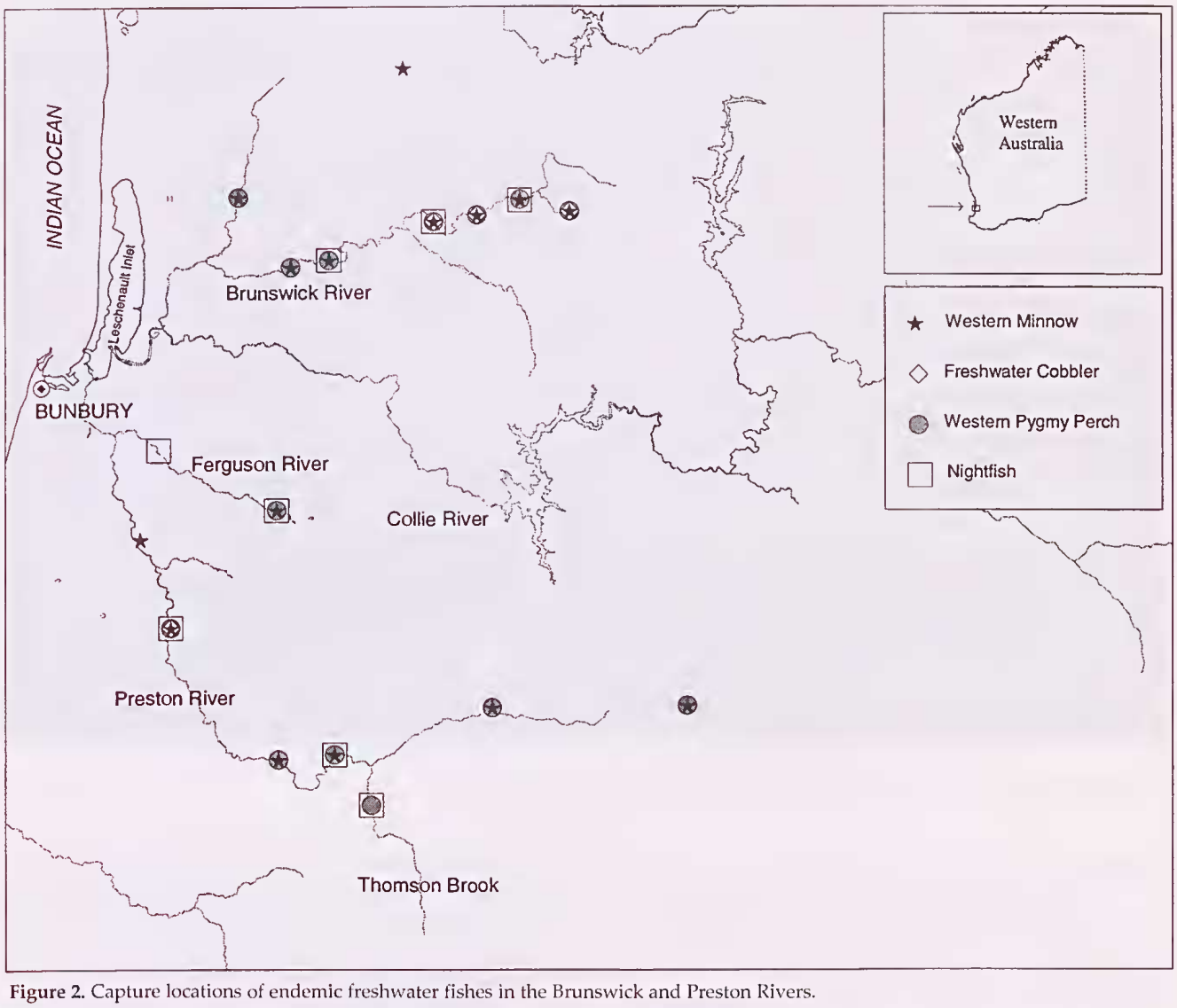

Figure 2. Capture locations of endemic freshwater fishes in the Brunswick and Preston Rivers.

fish with far greater recruitment occurring in the Preston River where large numbers of new recruits (0+) were captured. The species was captured up to a size of 60 mm TL in both the Brunswick and Preston rivers.

The Nightfish was found to be widespread throughout the Preston River but was restricted to the headwaters of the Brunswick River (Fig. 2). While a number of larger individuals were captured (up to ~150 mm TL and 140 mm TL in the Brunswick and Preston Rivers, respectively) many new recruits were also caught.

Estuarine fishes in the freshwaters

Within the Brunswick River the marine/estuarine opportunistic Yellow-eye Mullet (*Aldrichetta forsteri* (Valenciennes, 1836)) and Whitebait (*Hyperlophus vittatus* (Castelneu, 1875)) and the marine straggler Blue Sprat (*Spratelloides robustus* Ogilby, 1897) were captured at the limit of tidal influence, as were the typically estuarine Western Hardyhead (*Leptatherina wallacei* Prince, Ivantsoff & Potter, 1982), the Swan River Goby (*Pseudogobius olorum* (Sauvage, 1880)) and the South-western Goby (*Afurcagobius suppositus* (Sauvage, 1880)). While these species were not found in the freshwater environment of the Brunswick River; both the South-western Goby and the Western Hardyhead were captured in the freshwaters of the Preston River.

During this study we captured what appeared to be an Empire Gudgeon [*Hypseleotris compressa* (Kraefft, 1864)] (Fig. 3) at site 10 downstream of the gauging station weir at Boyanup on the Preston River (Fig. 1). In agreement with published morphological counts of the species in Hoese & Allen (1983), the 33 mm TL individual captured in the Preston River had: 2 pores on the preoperculum; 1st dorsal fin rays – VI; 2nd dorsal fin rays – I, 9; anal fin rays – I, 10; and an elongate vertical dark spot just below the base of the caudal fin.

Introduced Fishes

During this study we captured three introduced fishes, including: two Goldfish (*Carassius auratus* Linnaeus, 1758) from the Preston River at site 10 below the gauging station at Boyanup; a number of Rainbow Trout (*Oncorhynchus mykiss* (Walbaum, 1792)) from the upper Brunswick River; and Eastern Mosquitofish (*Gambusia holbrooki* (Girard, 1859)) from numerous sites throughout both systems (Figures 1 and 4).

Figure 3. The Empire Gudgeon (*Hypseleotris compressa*) captured in the Preston River.

Freshwater crayfish species captured

Two species of freshwater crayfish were captured during this study, the Gilgie (*Cherax quinquecarinatus* Gray, 1845) and the Marron (*Cherax cainii* Austin and Ryan, 2002) (Fig. 5). While the Gilgie was extremely widespread and often found in high densities, the Marron was less abundant and somewhat restricted (Fig. 5). For example, of the 269 and 335 freshwater crayfish captured in the Brunswick and Preston rivers, respectively, Gilgies represented ~97–98% of the catch in these systems.

Discussion

The Preston and Brunswick rivers were found to have very similar fish and crayfish communities. For example, approximately 60% of the fish captured in both rivers were from four freshwater fish species that are endemic to south-western Australia. Pen & Potter (1990, 1991a, b, c) and Morgan *et al.* (1998) also reported these species from the Collie River. The majority of the remaining fishes captured in the Brunswick and Preston rivers consisted of two and three introduced species, respectively.

The gauging station weir at Boyanup on the Preston River (site 10), and the weir at Brunswick Junction on the Brunswick River (site 2), had high congregations of the endemic species and it is likely that these weirs severely impact on the upstream migrations of many species within the river. For example, the Freshwater Cobbler undertakes upstream spawning migrations during late spring and summer and barriers would significantly impact on such movements. These barriers could be overcome with the construction of fishways such has recently occurred in other rivers in the region such as the Goodga River (Morgan & Beatty 2006) and Margaret River (Beatty *et al.* 2007).

The study recorded relatively large adult sizes of a number of endemic species; specifically the Western Minnow, Western Pygmy Perch and Nightfish. For example the maximum size of the Western Pygmy Perch is ~70 mm TL (Pen & Potter 1991c) and in the Brunswick and Preston Rivers they were captured up to 60 mm TL. Furthermore, the maximum size of the Nightfish is considered to be ~160 mm TL (Allen 1982) and fish within the Brunswick and Preston Rivers were caught approaching this size, *i.e.* up to ~150 mm TL and 140 mm TL, respectively. Therefore, in contrast to many rivers of the region that have been considerably altered by salinisation, eutrophication and/or river regulation (Morgan *et al.* 1998), these rivers appear to provide continuous flows and suitable permanent habitats that may have resulted in these species having high longevities.

A number of marine/estuarine fishes are often associated with the freshwater environments of south-western Australia, while a number of others are occasionally encountered within freshwaters (Morgan *et al.* 1998). The Leschenault Inlet acts as a nursery ground for numerous fishes of marine origin, such as the mullets (Mugilidae) (Potter *et al.* 2000), but also supports

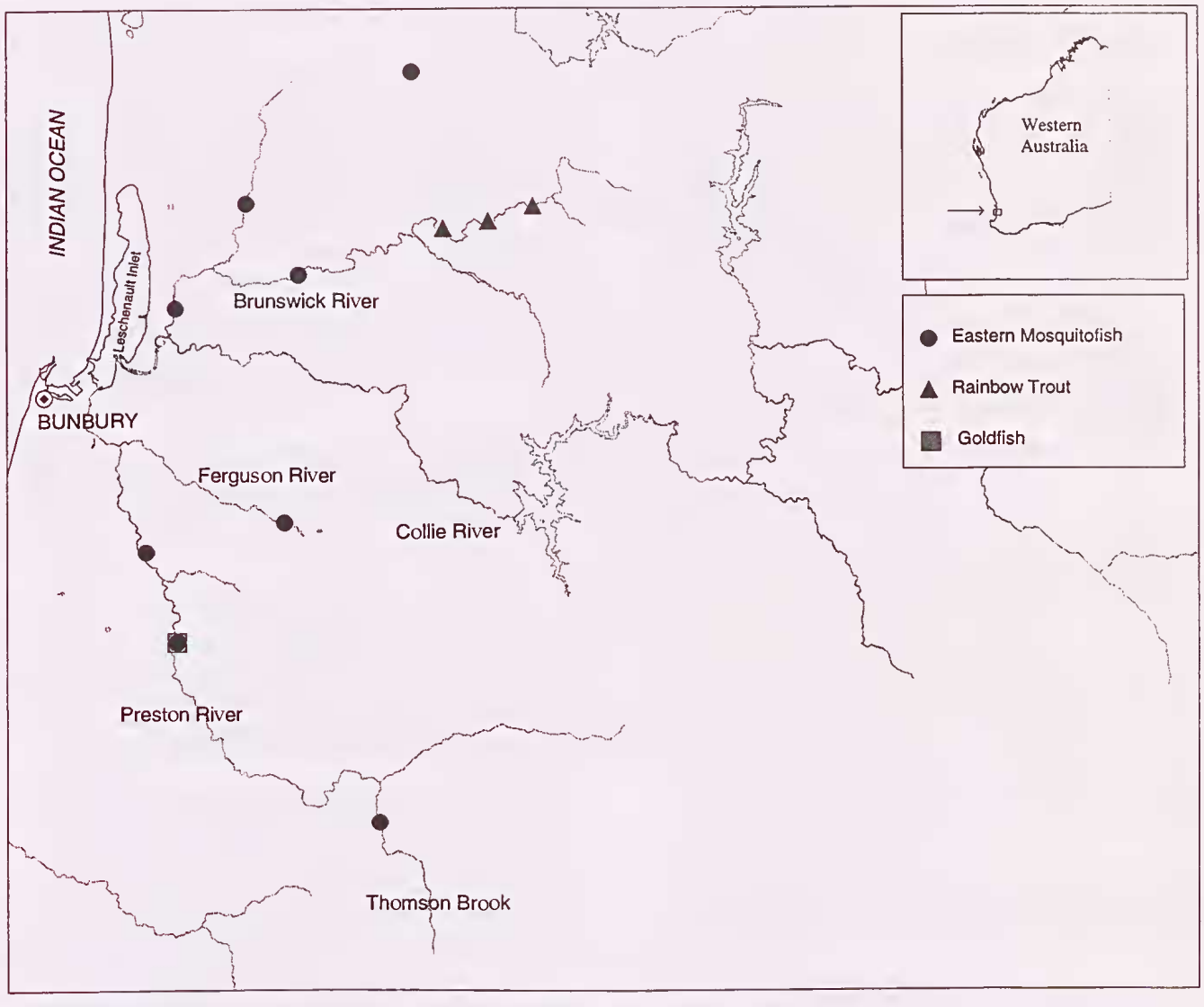

Figure 4. Capture locations of the introduced fishes in the Brunswick and Preston Rivers.

populations of a number of species that are termed estuarine. The typically estuarine Western Hardyhead, the Swan River Goby and the South-western Goby were found in both systems, however, only penetrated into the freshwater environments of the Preston River.

Each of these three species is commonly encountered within inland waters (rivers/lakes) of south-western Australia (Morgan *et al.* 1998). While it is not clear why these species do not move into the freshwaters of the Brunswick River, it is possible that either the channelised lower sections may not be conducive to these species or that the weir restricts their upstream movement.

The capture of a single Empire Gudgeon represents the first record of the species in the South-west Drainage Division. The capture of a single individual is surprising. It is possible that the individual may be an unwanted aquarium pet that entered the Preston River as the result of a deliberate release. However, it is also conceivable that it entered the system through the inlet from the marine environment as a larvae or juvenile from populations in the Pilbara (Indian Ocean) Drainage Division (see Morgan & Gill 2004). Gopurenko *et al.* (2003) reported that larval drift from the north, via the Leeuwin Current, was the most likely factor accounting for the recent colonisation of south-western Australian estuaries by another tropical species, the Mud Crab (*Scylla serrata* (Forsskål, 1755)).

Some may argue that the Empire Gudgeon is strictly a freshwater species, but captures in north-western Australia strongly suggest that the species should be considered an estuarine species that moves into freshwater (see Morgan & Gill 2004) and it is known to sometimes be present in full strength sea water (Hoese & Allen 1983). The nearest populations of the species are in the Chapman and Murchison Rivers; possibly a result of larval drift from its more northerly locations in the Pilbara and Kimberley Drainage Divisions (Morgan & Gill 2004). Within the rivers of the Pilbara it is generally found in the lower reaches of rivers or in estuaries, *e.g.* Murchison River (Morgan & Gill 2004). Regardless of how the individual came to be in the Preston River, the capture of a single individual in the current study, suggests a larger self-maintaining population has not become established; however, a follow up survey is required to confirm this assumption.

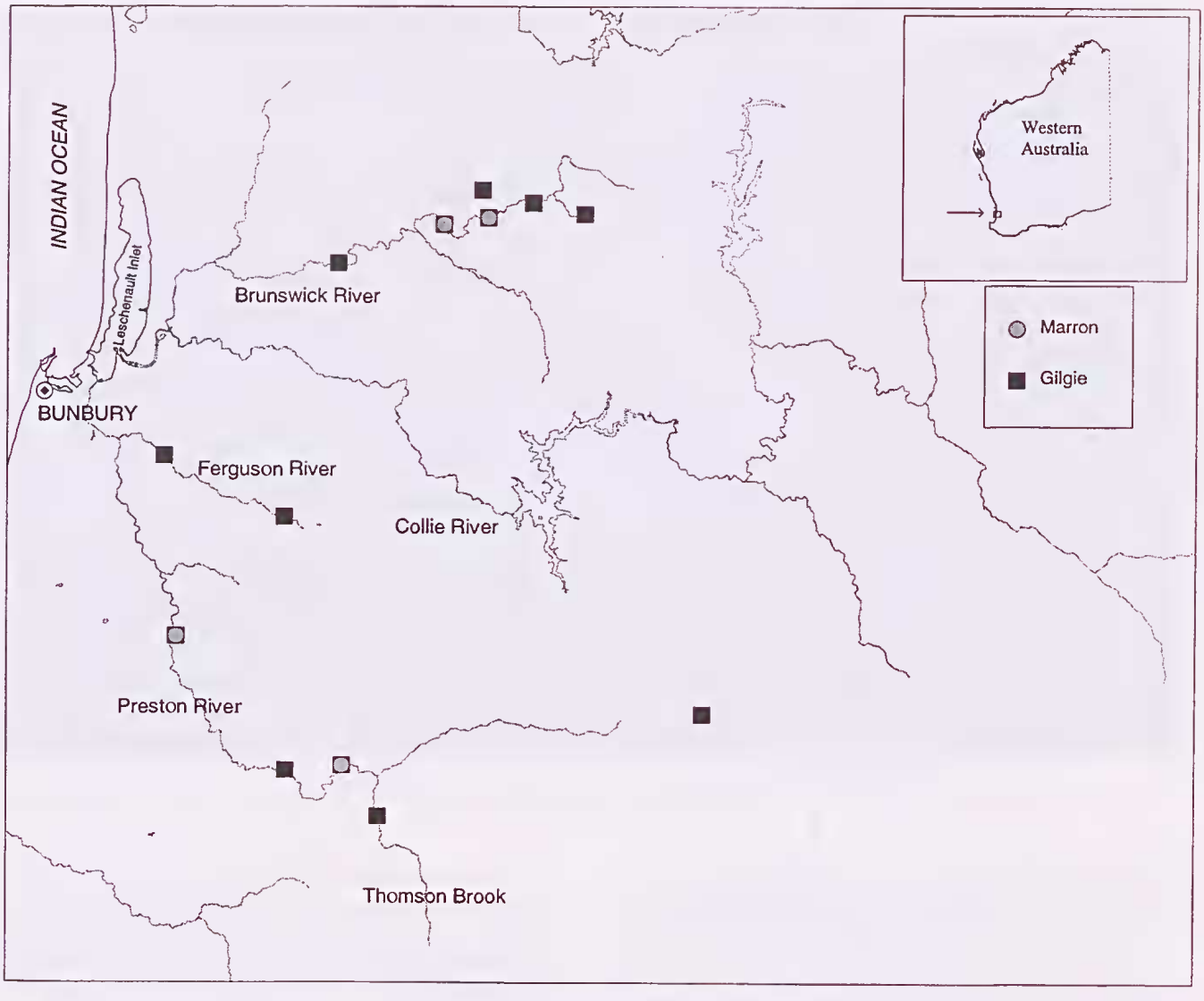

Figure 5. Capture locations of endemic freshwater crayfishes in the Preston and Brunswick Rivers.

A total of 10 species of introduced freshwater fish are reported from Western Australia (Morgan *et al.* 2004) with three of these (Goldfish, Rainbow Trout and Eastern Mosquitofish) being recorded during sampling in the current study. Other studies previously recorded Redfin Perch (*Perca fluviatilis* Linnaeus, 1758) in the Collie River (Morgan *et al.* 1998; Pen & Potter 1992).

As Goldfish were only found at site 10 below the weir on the Preston River (Figures 1 and 4), it is likely the barrier has limited their spread upstream. It may also suggest that the initial site of release was in the lower Preston River, potentially near the coastal urban centre of Bunbury (Fig. 1). Rainbow Trout were captured in the upper Brunswick River and these fish are most likely to have been fish that were stocked by the Department of Fisheries WA. Between 1999 and 2004 some 90000 Rainbow Trout fry were stocked into the Brunswick River, and a further 240000 fry and 8200 yearlings were stocked within the Collie River (Collie Gorge) during the same period. The impact of the continued stocking of trout into the Brunswick River should be assessed to determine predation levels on native fish and freshwater crayfish. Impacts of Western Australia's introduced fishes are summarised in Morgan *et al.* (2004), and range from competition for food and habitat with native fishes to predation on native fishes and crayfishes.

Conclusions

Perennial flows in the Brunswick and Preston Rivers support populations of a number of south-western Australia's endemic freshwater fishes, including the Western Minnow, Western Pygmy Perch, Nightfish, and Freshwater Cobbler. A number of typically estuarine fishes, including the Western Hardyhead, the Swan River Goby and the South-western Goby, were found within the freshwaters of the Preston River but none of these were found to penetrate into the freshwater environment of the Brunswick River. This study reported the Empire Gudgeon below the gauging station weir on the Preston River; the first record of it from the entire South-west Drainage Division. Its presence may have been due to either an aquarium release (either direct or is a progeny)

or larval drift from the Pilbara Drainage Division of Western Australia.

Two species of endemic freshwater crayfish, the Gilgie and the Marron, were found within these systems. Both rivers are also occupied by the introduced Eastern Mosquitofish, while Goldfish were captured in the Preston River and Rainbow Trout were found within the Brunswick River; presumably as a consequence of a stocking programme in that system. Although some research has recently been conducted on the impacts of introduced fishes in the region (Morgan *et al.* 2004 and references therein), specific catchment based assessments should occur together with quantification of the impacts of instream barriers to, in particular, migratory patterns of the highly endemic fishes of this region.

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